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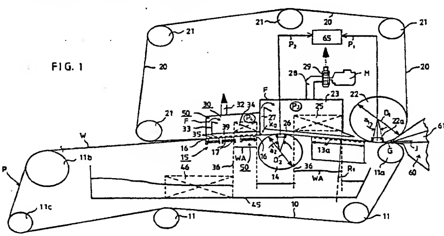
(54) Twin-wire former, in particular for high-speed paper machines

(57) A twin-wire former of a paper machine, for high-speed paper machines, whose web speed is of an order of ~ 1600...2500 m/min. The former comprises the loop of a carrying wire (10) and the loop of a covering wire (20). The wires (10,20) define a twin-wire zone and an inlet or forming gap (G) between the wires, a pulp suspension layer or a pulp suspension jet (J) being fed into said inlet or forming gap through the discharge duct of the headbox (60). The former comprises, as a combination, a first forming-suction roll (12;22), which is placed in the area of the forming gap (G). The former comprises a second forming-suction roll (14;24), which is placed inside the loop of the wire (10/20) opposite to the wire inside whose loop the first forming roll (12;22) is placed. The forming-suction rolls have suction zones (12a;22a,14a;24a), over which the twin-wire zone is curved on certain sectors (a_1,a_2). In the suction zones (12a;22a,14a;24a) the vacuum levels (p_1,p_2;p_{1L},p_{2L},p_{1H},p_{2H}) are arranged adjustable independently from one another so as to minimize the unequalsidedness of the web (W). After the second forming-suction roll (14;24), there is a pressure pulsation unit (50;23A,40) in the twin-wire zone.

FIG. 1



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Description

The invention concerns a twin-wire former of a paper machine, in particular for high-speed paper machines, whose web speed is of an order of ~ 1600...2500 m/min (metres per minute), which former comprises the loop of a carrying wire and the loop of a covering wire, which wires define a twin-wire zone and an inlet or forming gap between the wires, a pulp suspension layer or a pulp suspension jet being fed into said inlet or forming gap through the discharge duct of the headbox.

In the web formers of paper machines, a number of different forming members are used. The primary function of these members is to produce a compression pressure and pressure pulsation in the fibre layer that is being formed, by means of which pressure and pulsation the draining of water out of the web that is being formed is promoted and, at the same time, the formation of the web is improved. Said forming members include different forming shoes, which are usually provided with a curved ribbed deck and over which the forming wires placed one above the other and the web placed between them are curved. In the areas of these forming shoes, water is drained through the wire placed at the side of the outside curve because of the tensioning pressure of said wire, and this draining is aided further by a field of centrifugal force. Draining also takes placed through the wire placed at the side of the inside curve, which draining is, as a rule, intensified by the negative pressure present in the chamber of the forming shoe. The ribbed deck of the forming shoe produces pressure pulsation, which both promotes the dewatering and improves the formation of the web.

Further, in the prior art, so-called MB units are known, through which two wires run as a straight or curved run, which wires are placed one opposite to the other. In the prior-art MB units, inside the loop of one of the wires, there is a pressure loading unit, and inside the loop of the other, opposite wire, a draining unit is fitted which is provided with a set of guide and dewatering ribs. As is known from the prior art, said MB unit is, as a rule, placed on the Fourdrinier wire part, so that the MB unit is preceded by a single-wire portion of considerable length, in which a substantial proportion of draining of water takes place before the web runs as a straight run in the plane of the Fourdrinier wire through the MB unit. With respect to the details of construction of the prior-art MB units, reference is made, by way of example, to the applicant's FI Patent Applications Nos. 884109 and 885607.

In the prior art, a number of different hybrid formers and twin-wire formers are known which are provided with a MB unit or units of the type described above. With respect to these, reference is made to the following FI Patent Applications, 884109, 885608, 904489, 905447, 920228, 920863, 924289, 930927, 931950, 931951, 931952, 932265, 932793, and 934999.

In the prior-art roll-rib formers most closely related to the present invention, as a rule, one forming-suction roll is employed, which removes a considerable proportion, as a rule more than 50 %, of the flow quantity of the headbox before the pulp web is passed over the forming member that produces pressure pulses, such as a MB unit or a stationary forming shoe. In some prior-art formers, after the pressure-pulsation/forming member, a forming-suction roll is used, which is provided with high vacuum.

The latter formers involve the drawback that, when just one forming-suction roll is employed before the pressure-pulsation/forming member, the regulation of the vacuum level in said forming-suction roll has a strong effect on the face of the sheet only that is placed at the side of the forming-suction roll. Thus, the regulation of the vacuum in the forming-suction roll produces unequalsidedness in the sheet that is being formed, as will come out from the accompanying Fig. A, which will be described in more detail later. Since the level of the vacuum in said forming roll also affects the formation of the web, it is, as a rule, not possible to achieve minimal unequalsidedness and good formation of a sheet with the same operation parameters.

The object of the present invention is to provide a novel twin-wire former, in particular a gap former, which has a high speed potential and with which the web that is produced has a reduced unequalsidedness but, yet, good formation. Thus, the object of the invention is to provide a twin-wire former, in particular a gap former, for particularly high web speeds, which are typically of an order of 1600...2500 m/min. This speed range has not been attained by means of the prior-art formers.

In view of achieving the objectives stated above and those that will come out later, the invention is mainly characterized in that the former comprises, as a combination, a first forming-suction roll, which is placed in the area of the forming gap, that the former comprises a second forming-suction roll, which is placed inside the loop of the wire opposite to the wire inside whose loop the first forming roll is placed, that said forming-suction rolls have suction zones, over which the twin-wire zone is curved on certain sectors and in which suction zones the vacuum levels are arranged adjustable independently from one another so as to minimize the unequalsidedness of the web, and that, after the second forming-suction roll, there is a pressure pulsation unit in the twin-wire zone.

According to the invention, when a second forming-suction roll is used inside the wire loop opposite to the wire loop of the first forming-suction roll, the relationship between the vacuum levels in these forming-suction rolls can be chosen independently from one another to control the surface properties of both sides of the web, as comes out from the accompanying Fig. B, which will be described in more detail later. Thus, the former in accordance with the present invention differs substantially and advantageously from formers in which just one forming-suction roll is employed, in which formers, also at high speeds, the control of the properties of the opposite faces of the web independently from one another has not been possible.

By means of the magnitudes of the web-turning sectors of the forming-suction rolls used in the invention and by means of the control of the absolute levels of the vacuum in the suction zones placed on said sectors, it is possible to regulate the water-draining proportions of both forming-suction rolls so that a paper can be produced whose both faces are equal in respect of the absorption of ink or oil. In this way, the dry solids content of the web and its distribution in the z-direction can be kept in an optimal range when the web reaches the latter pressure pulsation unit, such as a MB unit.

Alternatively, the invention can be carried into effect so that the wire-contact sectors on both of the forming-suction rolls are made larger so that they are substantially equally large as compared with one another, being of the size of sector that is normally used in the prior-art roll-rib formers in which there is one forming-suction roll only. Owing to the increased water-draining capacity thus achieved, the former can be made suitable for particularly high speeds of ~ 1600...2500 m/min, which has not been possible in the prior-art formers in which there is just one forming-suction roll with a large wire-contact sector. This is achieved because, with two forming-suction rolls, the draining resistance in the twin-wire zone is developed more evenly, and the draining pressure can be increased further in the second forming-suction roll be choosing its diameter smaller than the diameter of the first roll, because on the second forming roll the draining resistance is higher than on the first one.

In the invention, by regulating the magnitude of the wire-contact sectors on both of the forming-suction rolls, the diameters of the forming rolls, and the vacuum levels, it is possible to keep the dry solids content of the web at an optimal level as it reaches the pressure pulsation unit, such as the MB unit, also with considerably higher web speeds, compared with the prior-art formers, at the same time as the unequalsidedness and the formation of the web can be controlled independently from one another.

In the following, the invention and the prior art and the physical phenomena that constitute the starting point of the invention will be described in more detail with reference to the figures in the accompanying drawing, the invention being by no means strictly confined to the details in said illustrations.

The diagram in Fig. A illustrates the effect of the vacuum in the forming-suction roll on the unequalsidedness of the web in prior-art roll-rib formers in which there is one forming-suction roll.

Figure B illustrates the regulation of the vacuum levels in the forming-suction rolls in a former, which comprises two forming-suction rolls in accordance with the invention, so as to achieve a minimal unequalsidedness of the web at different vacuum levels.

Figure 1 is a schematic side view of a first embodiment of the invention.

Figure 2 is a schematic side view of a second embodiment of the invention.

Figure 3 is a schematic side view of a third embodiment of the invention, in which no MB unit is employed.

Figure 4 is a schematic side view of a fourth embodiment of the invention.

The paper machine formers shown in Figs. 1 to 4 comprise the loop of the lower wire 10, which is guided by the guide rolls 11,11a,11b,11c, by the second forming-suction roll 14 (Figs. 1 and 4), by the breast roll 11a or by the first forming-suction roll 12. The formers comprise the loop of the upper wire 20, which is guided by the guide rolls 21, by the breast roll 21a or by the first forming roll 22 and by the second forming roll 24 (Figs. 2 and 3). Through the discharge duct 61 of the headbox 60 of the paper machine, the pulp suspension jet J is fed into the forming gap G defined by the forming wires 10 and 20, after which gap the twin-wire zone starts directly.

According to Figs. 1 and 4, at the beginning of the twin-wire zone, inside the upper-wire loop 20, there is the first forming-suction roll 22, which includes a suction zone 22a. The level of the vacuum p_1 in the suction zone 22a can be regulated by means of the suction devices 65 in themselves known. In Figs. 1 and 4, the forming gap G is defined from below by the lower wire 10 running over the breast roll 11a.

In Figs. 2 and 3, the first forming-suction roll 12 is placed inside the lower-wire loop 10, and the forming gap G is defined from above by the upper wire 20 which runs over the breast roll 21a.

The twin-wire zone is in contact with the first forming roll 12;22 on the sector a_1, which is followed by a run of the wires 10,20 on which there is a stationary forming shoe 13 inside the lower-wire loop 10. The forming shoe is provided with a ribbed deck 13a, which has a large curve radius R_1, whose curve centre is placed at the side of the lower wire 10. Said curve radius R_1 is chosen preferably in the range of $R_1 \approx 3...8$ m. Facing the forming shoe 13, inside the loop of the upper wire 20, there is a suction-deflector box 23, at whose rear edge there is a deflector rib 23a operating against the inner face of the upper wire 20. The water draining from the web W through the upper wire 20 at the top and front side of the forming shoe 13 is passed through the space 26 placed below the box 23 and through the suction-deflector duct 27, in the direction of the arrow F, into the box 23, from which the water is drained through the duct 25 connected with the suction leg 36. In the box 23, a suitable vacuum level p_3 is maintained by means of a blower 29 driven by a motor M. The blower 29 communicates through the duct 28 with the box 23, and the air is removed from it in the direction of the arrow.

According to Figs. 1 and 4, underneath the rear end of the suction-deflector box 23, inside the loop of the lower wire 10, a second forming-suction roll 14 is fitted, which includes a suction sector 14a. The suction sector 14a communicates with a vacuum source 65 so that the vacuum level p_2 in the suction sector 14a is adjustable. According to Figs. 2 and 3, the second forming-suction roll 24 is placed inside the loop of the upper wire 20 after the suction-deflector box 23. The twin-wire zone is curved by means of the second forming-suction roll 14;24 over the sector a_2.

According to Figs. 1, 2 and 4, the second forming-suction roll 14;24 is followed in the twin-wire zone by the MB unit 50. The MB unit 50 shown in Figs. 1 and 4 is directly connected with the preceding suction-deflector box 23. Said MB unit 50 comprises a dewatering box 30, which communicates with the suction leg 36 through the duct 34, the water level in said suction leg being denoted with WA. Underneath the dewatering box 30, there is a fixed set of support ribs 35. In Figs. 1 and 4, there is the loading unit 15 of the MB unit 50, which loading unit operates against the set of ribs 35 and which loading unit comprises loading ribs 16 loaded by means of pressure medium passed into the pressure hoses 17 or by means of an equivalent power arrangement, said loading ribs 16 being placed facing the gaps between the support ribs 35. Above the set of support ribs 35, a space 39 is opened, through which the water drained through the upper wire 20 is passed, aided by the negative pressure p_4 in the box 30, through the duct 33, in the direction of the arrow F, into the box 30. The box 30 communicates through the duct 32 with a vacuum source (not shown).

Fig. 2 shows a MB unit in which there are two successive dewatering chambers 30a and 30b. The first chamber 30a is a suction-deflector chamber, whose suction duct 33a is opened above the first fixed support rib 35. The first chamber 30a communicates through the duct 32a with the blower 29 driven by the motor M. From the chamber 30a, the water is drained through the duct 34a into the suction leg 36. Underneath the first suction chamber 30a, there is a loading unit 15 similar to that described above, in which there are loading ribs 16 loaded by means of pressure passed into the hoses 17 and placed facing the gaps between the fixed support ribs 35. Through the gaps between the support ribs 35, the water is drained through the upper wire 20 through the space 39 into the duct 33b and from there further, in the direction of the arrow F, into the second suction chamber 30b. The second suction chamber communicates through the duct 32b with a vacuum source (not shown). From the chamber 30b, the water is drained through a duct 34b communicating with the suction leg 36. The vacuum levels p_{41} and p_{42} present in each of the chambers 30a and 30b can be regulated independently from one another. Through the suction-deflector duct 33a of the first chamber 30a, primarily the water is drained that is separated from the web W directly after the second suction roll 24.

In Fig. 3, after the suction roll 24, no MB unit is placed, but in said location, inside the upper-wire loop 20, there is a suction-deflector chamber 23A. Underneath this chamber, inside the lower-wire loop 10, there is a suction box 40, which is provided with a ribbed deck 40a, which either is straight or has a very large curve radius R_2. At the rear edge of the ribbed deck 40a, there is a deflector rib 23b, which defines the space 26 underneath the chamber 23A. Through this space 26, the water drained through the upper wire 20 flows in the direction of the arrow F into the chamber 23A and from there further through the duct 34a into the suction leg 36. The chamber 23A communicates through the duct 32a with a blower 29 driven by a motor M so as to maintain an adjustable vacuum level p_4 inside the chamber 23A.

According to Fig. 1, after the MB unit 50, the paper web W follows the lower wire 10, from which it is separated at the pick-up point P and is transferred to the press section (not shown). According to Figs. 2 and 3, after the MB unit and the suction-deflector chamber 23A, inside the lower-wire loop 10, there are suction flatboxes 18. In Fig. 4, after the MB unit 50, inside the loop of the lower wire 10, there is a third forming-suction roll 41, which includes a suction sector 41a. On this sector, the twin-wire zone is curved downwards, after which the web W is separated from the upper wire 20 and transferred over the suction flatboxes 18 to the pick-up point P. In the figures, a water collecting basin 45 is shown, which is fitted inside the lower-wire loop 10 and which is connected with the wire pit (not shown) through the drain duct 46.

As to the measures of the forming rolls 12;22,14;24 in the former in accordance with the invention, it should be stated that the diameter D_1 of the first forming roll 12;22 is, as a rule, chosen in the range of $D_1 \approx 0.9...1.7$ m. The contact sector a_1 of the wires on the first forming roll is chosen in the range of $a_1 \approx 0°...45°$. Said sector $a_1 = 0°$ means just a tangential contact alone. The choice of said parameters D_1 and a_1 depends on the machine speed and on the paper grade that is produced. For newsprint, said parameters are preferably $D_1 \approx 1.6$ m and $a_1 \approx 25°$. With other grades, the choice differs from the above.

The diameter D_2 of the second forming roll 14;24 is chosen in the range of $D_2 \approx 0.9...1.7$ m, and the sector of contact $a_2 \approx 15°...45°$. Moreover, as a rule, the choice is made that $D_1 > D_2$ in order that the dewatering pressure could be increased on the second forming-suction roll 14;24 because of the increased draining resistance of the web W. For newsprint, said parameters are preferably chosen so that $D_2 = 1.23$ m, and $a_2 = 20°$. The forming shoe 13 placed between the first and the second forming-suction roll is kept as short as possible. The length L in the machine direction of the ribbed deck 13a is chosen so that $L \approx 300$ mm when $R_1 \approx 5$ m. The curve radius R_1 of the ribbed deck 13a is chosen in the range of $R_1 \approx 3...8$ m.

The vacuum levels p_1 and p_2 in the suction zones of the forming-suction rolls 12;22,14;24 are arranged adjustable, and said vacuum levels p_1 and p_2 are, as a rule, chosen in the range of $p_1 \approx 0 ... 25$ kPa and $p_2 \approx 0 ... 35$ kPa.

In the following, the drawbacks in the prior art, the physical background of the invention, and the mode of effect of the invention will be described with reference to the diagrams in Figs. A and B.

The diagram in Fig. A illustrates the absorptions of oil (grams per square metre), measured with the UNGER test, at the opposite sides of the web (YP = top side, AP = bottom side) as a function of the vacuum (level of negative pressure) in the forming-suction roll in a prior-art roll-rib former in which there is one forming-suction roll

only. In Fig. A, the side facing the forming roll is, at the same time, the top side of the web that is produced. It is seen from Fig. A that the unequalsidedness of the web increases in a substantially linear way when the vacuum level' in the forming-suction roll is increased, which results in the drawbacks discussed above.

The diagram in Fig. B illustrates the mode of effect of the invention. Fig. B illustrates the absorption (e.g., UNGER) as a function of the vacuum (level of negative pressure) in the forming rolls 12;22,14;24. The graph A_{yp} drawn with the solid line shows the absorption at the top side of the sheet in relation to the vacuum in the forming roll placed underneath, and correspondingly the graph A_{ap} drawn with the dashed line shows the absorption at the bottom side of the sheet in relation to the vacuum in the upper former roll. From the graphs A_{yp} and A_{ap} in the figure, it comes out that the absorption at the opposite side of the sheet, opposite in relation to the forming-suction roll, is in practice substantially independent from the vacuum level in said forming-suction roll. The graph B_{ap} in Fig. B illustrates the dependence of the absorption at the bottom side of the sheet as a function of the vacuum level in the forming-suction roll placed at the same side, i.e. at the bottom side. In a corresponding way, the graph B_{yp} illustrates the absorption at the top side of the sheet as a function of the vacuum level in the forming-suction roll at the same side, i.e. at the top side. If the aim is to avoid unequalsidedness of the sheet, i.e. the ratio of the absorptions at the top and bottom sides of the sheet is = 1, in such a case, at high web speeds or when otherwise high vacuum levels are used in the forming-suction rolls, in the horizontal plane indicated by the arrow R_H the vacuum levels p_{2H} and p_{1H} of the forming-suction rolls 12;22,14;24 are chosen. When low vacuum levels are used, in the horizontal plane indicated by the arrow R_L the vacuum levels p_{2L} and p_{1L} of the forming-suction rolls 12;22,14;24 are chosen. In this way, unequalsidedness of the web can be avoided at all available vacuum levels and even at high web speeds.

In the following, the patent claims will be given, and the various details of the invention may show variation within the scope of the inventive idea defined in said claims and differ from the details described above for the sake of example only.

A twin-wire former of a paper machine, for high-speed paper machines, whose web speed is of an order of ~ 1600...2500 m/min. The former comprises the loop of a carrying wire (10) and the loop of a covering wire (20). The wires (10,20) define a twin-wire zone and an inlet or forming gap (G) between the wires, a pulp suspension layer or a pulp suspension jet (J) being fed into said inlet or forming gap through the discharge duct of the headbox (60). The former comprises, as a combination, a first forming-suction roll (12;22), which is placed in the area of the forming gap (G). The former comprises a second forming-suction roll (14;24), which is placed inside the loop of the wire (10/20) opposite to the wire inside whose loop the first forming roll (12;22) is placed. The forming-suction rolls have suction zones (12a;22a,14a;24a), over which the twin-wire zone is curved on certain sectors (a_1,a_2). In the suction zones (12a;22a,14a;24a) the vacuum levels (p_1,p_2;p_{1L},p_{2L},p_{1H},p_{2H}) are arranged adjustable independently from one another so as to minimize the unequalsidedness of the web (W). After the second forming-suction roll (14;24), there is a pressure pulsation unit (50;23A,40) in the twin-wire zone.

Claims

1. A twin-wire former of a paper machine, in particular for high-speed paper machines, whose web speed is of an order of ~ 1600...2500 m/min, which former comprises the loop of a carrying wire (10) and the loop of a covering wire (20), which wires (10,20) define a twin-wire zone and an inlet or forming gap (G) between the wires, a pulp suspension layer or a pulp suspension jet (J) being fed into said inlet or forming gap through the discharge duct of the headbox (60), **characterized** in that the former comprises, as a combination, a first forming-suction roll (12;22), which is placed in the area of the forming gap (G), that the former comprises a second forming-suction roll (14;24), which is placed inside the loop of the wire (10/20) opposite to the wire inside whose loop the first forming roll (12;22) is placed, that said forming-suction rolls have suction zones (12a;22a,14a; 24a), over which the twin-wire zone is curved on certain sectors (a_1,a_2) and in which suction zones (12a;22a,14a;24a) the vacuum levels (p_1,p_2;p_{1L},p_{2L},p_{1H},p_{2H}) are arranged adjustable independently from one another so as to minimize the unequalsidedness of the web (W), and that, after the second forming-suction roll (14;24), there is a pressure pulsation unit (50;23A,40) in the twin-wire zone.

2. A former as claimed in claim 1, **characterized** in that, of said forming wires (10,20), the carrying wire is the lower wire (10), and the covering wire is the upper wire (20), which wires together define a substantially horizontal twin-wire zone.

3. A former as claimed in claim 1 or 2, **characterized** in that, between said first and second forming-suction roll (12a;22a,14a;24a), in the twin-wire zone, there is a stationary forming member fitted inside the loop of the carrying wire (10), preferably a forming shoe (13) provided with a curved ribbed deck (13a).

4. A former as claimed in claim 3, **characterized** in that, inside the loop of the lower wire (10), between the first and the second forming-suction roll (12;22, 14;24), there is a stationary forming shoe (13) provided with a curved (R_1) ribbed deck (13a), opposite to which deck, inside the upper-wire loop (20), there is a suction-deflector box (23), at whose trailing side, in the running direction of the web (W), there is a

deflector rib (23a), above which a suction-deflector duct (27) is opened, which passes into the dewatering chamber (23), and that said suction-deflector box (23) communicates with a vacuum source (29).

5. A former as claimed in any of the claims 1 to 4, **characterized** in that, after the second forming-suction roll (14;24), in the twin-wire zone, a MB unit (50) is fitted as a pressure pulsation unit, which MB unit comprises sets of ribs (16,35) loaded against one another and a suction chamber (30) or suction chambers (30a, 30b), which is/are placed inside the loop of the upper wire (20) and which communicate with a vacuum source (29).

6. A former as claimed in any of the claims 1 to 4, **characterized** in that, after the second forming-suction roll (24), inside the loop of the upper wire (20), a suction-deflector chamber (23A) is fitted, which communicates with a vacuum source (29) and which suction-deflector chamber (23A) comprises a deflector rib (23b) operating against the inner face of the covering wire (20), above which deflector rib a suction-deflector duct (33a) is opened, and that, facing said suction-deflector chamber (23A), inside the lower-wire loop (10), a stationary set of ribs (40a) is fitted, preferably a set of ribs (40a) that guides the twin-wire zone with the large curve radius (R_2) of the forming shoe (40), the suction-deflector rib (23b) being preferably placed in the area of the rear-end rib of said set of ribs (40a).

7. A former as claimed in any of the claims 1 to 6, **characterized** in that the MB unit (50) comprises a dewatering chamber (30) fitted inside the upper-wire loop (20), a stationary set of support ribs (35) being fixed below the space (39) placed underneath said dewatering chamber (30), against which set of support ribs (35) a set of loading ribs (16) operates, which is placed inside the lower-wire loop (10) and which is loaded by means of pressures passed into the loading hoses (17) or by means of equivalent power units.

8. A former as claimed in any of the claims 1 to 7, **characterized** in that, depending on the paper grade produced and on the web speeds, the diameter D_1 of the first forming-suction roll (12;22) has been chosen in the range of $D_1 \approx 0.9...1.7$ m, and the curve sector a_1 of the twin-wire zone on the first forming-suction roll (12;22) has been chosen in the range of $a_1 \approx 0°...45°$, and that the diameter D_2 of the second forming-suction roll (14;24) has been chosen in the range of $D_2 \approx 0.9...1.7$ m, and the curve sector a_2 of the twin-wire zone on the second forming-suction roll (14;24) has been chosen in the range of $a_2 \approx 15°...45°$.

9. A former as claimed in claim 8, which is intended for the manufacture of newsprint in a web-speed range of ~ 1600...2500 m/min, **characterized** in that the parameters mentioned above have been chosen as follows: $D_1 \approx 1.6$ m, $a_1 \approx 25°$, $D_2 \approx 1.2$ m, and $a_2 \approx 20°$.

10. A former as claimed in any of the claims 1 to 9, **characterized** in that, in the twin-wire zone between the first and the second forming-suction roll (12;22, 14;24), the curve radius R_1 of the ribbed deck (13a) of the forming shoe (13) placed inside the loop of the lower wire (10), whose curve centre is placed at the side of the loop of the lower wire (10), has been chosen in the range of $R_1 \approx 3...8$ m.

ABSORPTIO VS VACUUM IN FORMER ROLL

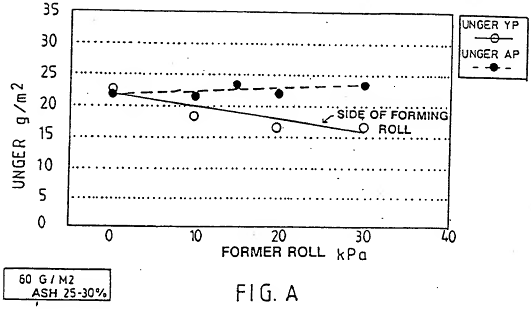


FIG. A

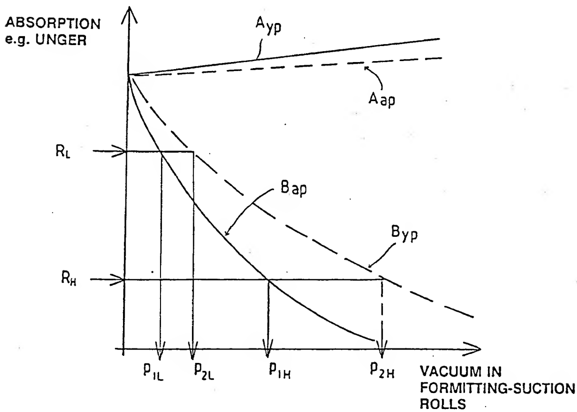
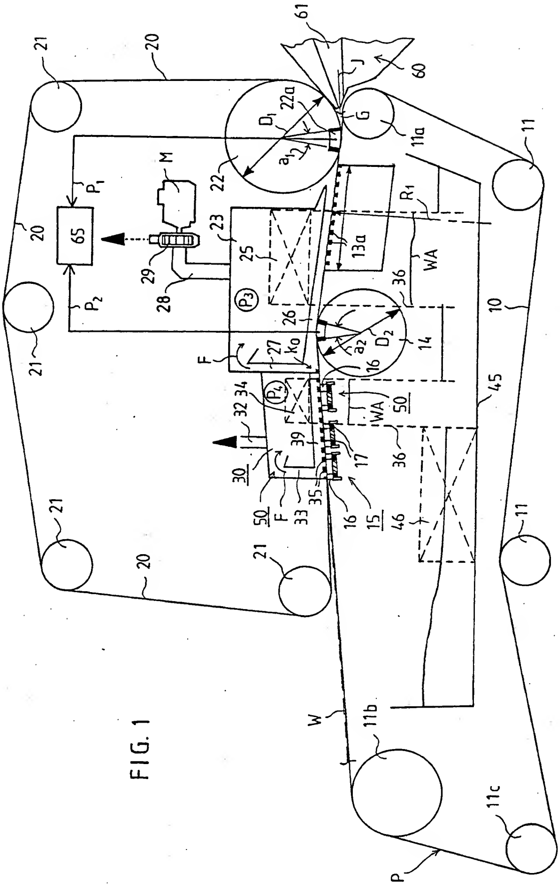


FIG. B



65
M
29
28
P1
P2
P3
P4
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11
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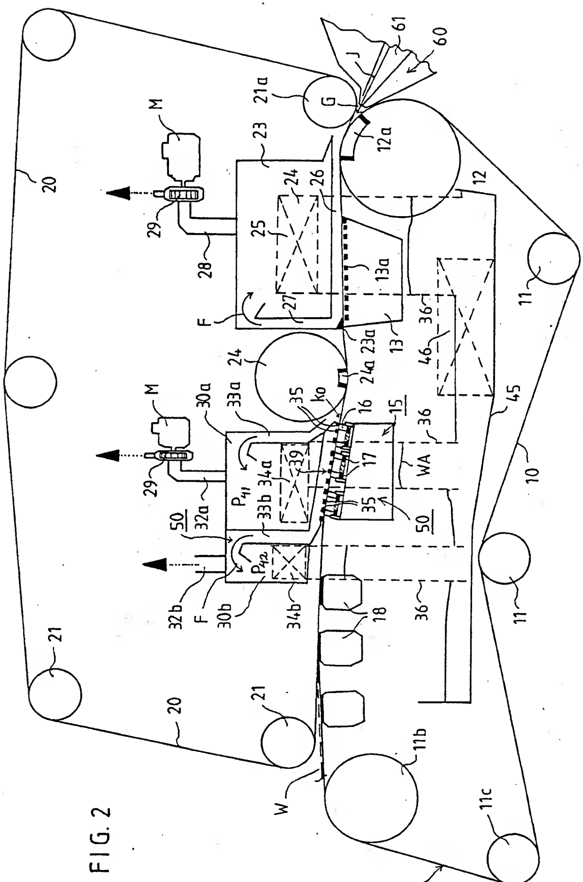
FIG. 1



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12a
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11
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30a
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P41
34a
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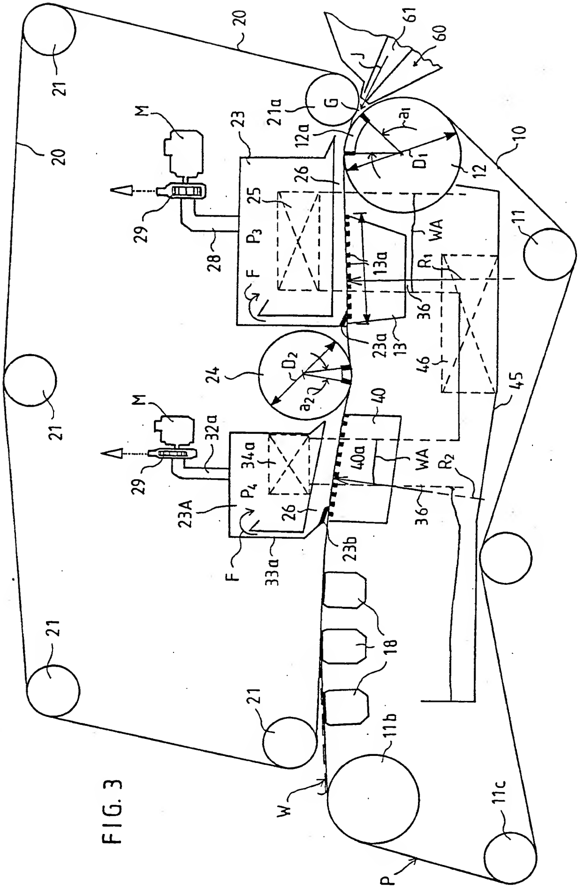
FIG. 2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D2
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a2
32a
M
34a
40a
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FIG. 3

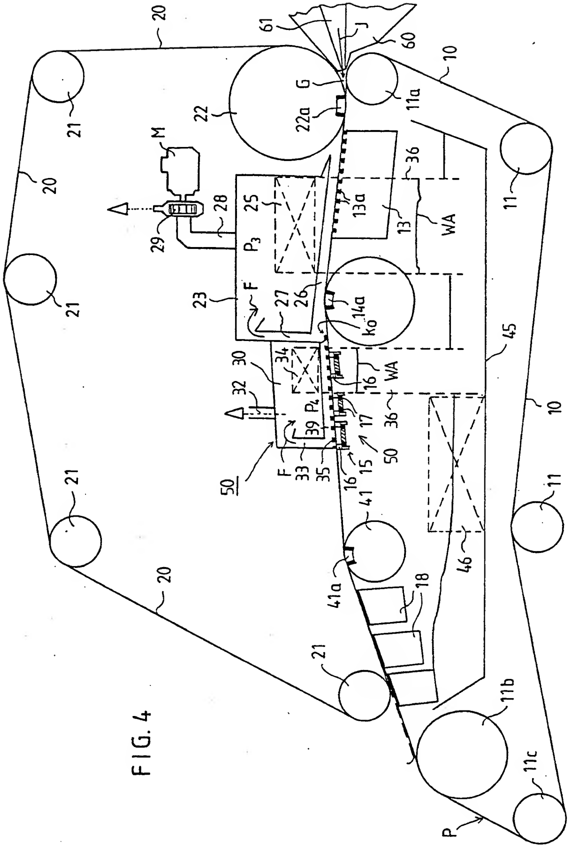

FIG. 4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 2221

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 300 547 (OY TAMPELLA AB) * the whole document * ---	1-3,8,9	D21F9/00
A	US-A-4 925 531 (KOSKI) * the whole document * ---	1-3,5-9	
A	DE-A-42 08 681 (SULZER-ESCHER WYSS) * the whole document * ---	1-4	
A	EP-A-0 475 921 (VALMET PAPER MACHINERY) * the whole document * -----	1-3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 December 1995	De Rijck, F

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